North American Journal of Fisheries Management 25:1528–1532, 2005

DOI: 10.1577/M05-033.1

[Management Brief]

Use of a Chase Boat for Increasing Electrofishing Efficiency for Flathead Catfish in Lotic Systems

DANIEL J. DAUGHERTY AND TRENT M. SUTTON*

Purdue University, Department of Forestry and Natural Resources, 195 Marsteller Street, West Lafayette, Indiana 47907, USA

Abstract.—Chase boats are commonly used to increase the catch efficiency of boat electrofishing for flathead catfish *Pylodictis olivaris*. However, use of a second vessel requires additional personnel, equipment, and budgetary resources that may influence decisions regarding sample planning efforts. While the efficacy of chase boats has been examined for lentic environments, no such studies have been documented for lotic systems. During 2002 and 2003, we compared low-voltage electrofishing catch efficiency with and without the use of a chase boat for three flow-rate classes in the lower St. Joseph River, Michigan. The median percentage of flathead catfish captured was significantly greater when a chase boat was used (60% of immobilized fish observed) than when a chase boat was not used (33%) at sampling locations with moderate flow rates (0.31–0.6 m/s). However, the catch efficiency with and without the use of a chase boat did not significantly differ at sampling locations with low (0–0.3-m/s) and high (>0.6-m/s) flow rates (range, 50–70%). Length-frequency distributions of flathead catfish were not significantly different between samples collected by electrofishing with or without a chase boat. Our results suggest that study objectives should be considered when determining whether to use a chase boat while boat electrofishing for flathead catfish in lotic systems.

The increasing popularity of fisheries for flathead catfish *Pylodictis olivaris* and the species' effect on native fishes in areas where it has been introduced have resulted in a need to develop a greater understanding of the flathead catfish population dynamics and status (Stauffer et al. 1996; Jackson 1999; Daugherty and Sutton 2005). Standard DC, low-voltage AC, and low-frequency pulsed DC boat electrofishing methods are commonly used to sample flathead catfish populations in lentic and lotic environments (Weeks and Combs 1981; Gilliland 1988; Cunningham 2004; Daugherty and Sutton 2005). However, these techniques may be labor intensive because a chase boat is commonly employed to increase capture efficiency (Robinson 1994; Cunningham 1995; Stauffer and Koenen 1999; Vokoun and Rabeni 1999). Stunned flathead catfish generally surface within 45 s after sampling has been initiated, remain tetanized for 60–90 s, and are distributed widely around the electrical field (Hale et al. 1987; Gilliland 1988; Justus 1996; Cunningham 1995). Morris and Novak (1968) reported that flathead catfish were observed up to 30 m away from the electrofishing vessel during low-voltage AC electrofishing efforts in the Missouri River, Nebraska. Similarly, Gilliland (1988) reported that flathead catfish surfaced up to 50 m away from the electrofishing boat in Oklahoma lakes and rivers. A chase boat can carry up to two extra dipnetters available for targeting fish that surface away from the electrofishing boat (Vokoun and Rabeni 1999; Cunningham 2004).

Previous studies have estimated that 40–75% of flathead catfish tetanized during electrofishing efforts are captured; a majority of these fish are collected by the chase boat (Cunningham 1995, 2000, 2004). However, the use of a second vessel requires additional personnel, equipment, and budgetary resources that may influence sample planning efforts. Therefore, it is important to determine capture efficiency associated with the use of a chase boat during electrofishing surveys of flathead catfish. Cunningham (2004) determined that chase boats did not significantly increase flathead catfish capture efficiency in three Oklahoma reservoirs. However, no studies have evaluated the use of a chase boat in riverine environments. Stauffer and Koenen (1999) suggested that a chase boat may be important in lotic systems because river currents and turbidity may transport tetanized fish downstream beyond the reach of dipnetters in the electrofishing boat. Robinson (1994) reported that a chase boat accounted for up to 50% of the flathead catfish collected in the Missouri River, Missouri. These studies suggest that chase boat use in riverine environments may result in greater catch rates than in lentic systems. The objective of our study was to evaluate the utility of a chase boat for capturing flathead catfish by boat electrofishing

* Corresponding author: tsutton@purdue.edu.

Received February 26, 2005; accepted June 14, 2005
Published online November 4, 2005

in the lower St. Joseph River, Michigan. The results of this study will provide fisheries managers with information necessary to make decisions regarding the use of project resources when sampling flathead catfish in lotic environments.

Methods

Study site.—The St. Joseph River, a tributary of Lake Michigan, is located in southwestern Michigan and northeastern Indiana. The free-flowing (hereafter referred to as lower) section of the river is a 37.6-km reach between the Berrien Springs Dam (Berrien Springs, Michigan) and the mouth of the river at Lake Michigan. Mean channel width was 130 m (range, 50–250 m); mean water depth was 1.6 m (range, 0.3–8.2 m), but lateral-scour pools with water depths exceeding 7 m occurred throughout the reach. Summer (June–August) water temperatures ranged up to 28°C. Mean dissolved oxygen was 9.6 mg/L (range, 6.9–14.1 mg/L), and mean turbidity was 16.5 nephelometric turbidity units (NTU; range, 11–27 NTU). Instream habitat was comprised of large woody debris and rip-rap (irregular concrete blocks up to 1 m in diameter and 0.2 m thick), and few aquatic macrophytes occurred in the system.

Fish collections.—Flathead catfish were collected from June through September of 2002 and 2003 by use of a modified-predator approach as defined by Vokoun and Rabeni (1999). The entire study reach was sampled weekly with 24–38-V AC produced by a three-bar magnetic motor as described by Morris and Novak (1968). Although sampling was conducted in all habitat types (i.e., main-channel pools, riffles, and runs with and without structure), efforts were concentrated in the structural habitats typically occupied by flathead catfish (e.g., large woody debris jams, timbered channels, undercut banks, rip-rap, etc.; Cunningham 2000; Daugherty and Sutton 2005) at water depths ranging from 0.5 to 8.0 m. Water temperatures during sampling ranged from 22°C to 28°C.

At each sampling location, two 18-gauge insulated wires (each 6.1 m in length) with the distal ends connected to aluminum-bar electrodes (30.5 cm long and 2.5 cm wide) were attached to the motor terminals and were powered by a 14.4-V cordless drill connected to the motor driveshaft. The electrofishing boat was held stationary at the sampling location, and electrical current was applied continuously for 90 s by operating the magnetic motor at an approximate speed of 300 revolutions per minute. During sampling occasions when a chase boat was employed, the 4.9-m aluminum flat-bottom boat was positioned 50 m downstream of the electrofishing vessel to prevent fish from drifting downstream undetected. Personnel (one netter and one operator per boat) and environmental conditions (e.g., water temperature, turbidity, season, and discharge) were standardized between years to eliminate potential biases (Cunningham 2004).

TABLE 1.—Distribution of flathead catfish sampling locations where low-voltage AC electrofishing was used with and without a chase boat at low (0–0.3-m/s), moderate (0.31–0.6-m/s), and high (>0.6-m/s) flow rates in the lower St. Joseph River, Michigan, 2002–2003.

Flow rate	Chase boat	No chase boat
Low	108	117
Moderate	94	159
High	27	15
Total	229	292

Data analyses.—At each sampling location, the number of flathead catfish observed and the number and total length (TL; measured to the nearest 1 mm) of each captured flathead catfish were recorded. Water flow rate (m/s) was recorded by use of a mechanical flowmeter at each sampling location. Capture efficiency (%) was calculated as the number of captured fish divided by the total number of fish observed at each sampling location. Capture efficiency data were categorized into three flow-rate classes (low, 0–0.3 m/s; moderate, 0.31–0.6 m/s; high, >0.6 m/s), and Mann–Whitney rank-sum tests were used to determine whether capture efficiency differed significantly between sampling methods for each flow-rate class. Length frequency distributions of flathead catfish collected with and without a chase boat were compared by use of a Kolmogorov–Smirnov two-sample test. All statistical analyses were conducted using SPSS 11.0 (SPSS 2001) at a significance level α of 0.05. Sampling efforts during which no flathead catfish were observed were omitted from statistical analyses.

Results and Discussion

A total of 631 flathead catfish were captured during the study period. A total of 229 flathead catfish were collected during the 292 sampling efforts that occurred without a chase boat, and an additional 402 fish were collected during the 229 sampling efforts that involved use of a chase boat (Table 1). The median flathead catfish capture efficiency at moderate flow rates was significantly greater when a chase boat was used (60%) than

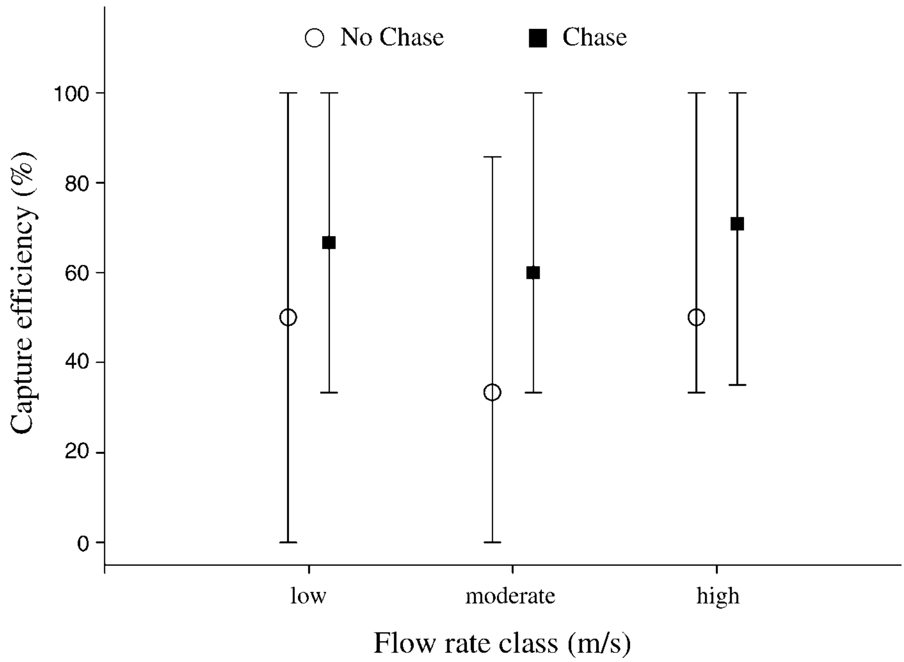

FIGURE 1.—Median percentage of flathead catfish collected by low-voltage AC electrofishing with and without a chase boat at low (0–0.3-m/s), moderate (0.31–0.6-m/s), and high (>0.6-m/s) flow rates in the lower St. Joseph River, Michigan, during 2002 and 2003. Error bars indicate 25th and 75th percentiles.

when a chase boat was not used (33%; $T = 9{,}202$, $P = 0.003$; Figure 1). However, median catch efficiency of flathead catfish at low and high flow rates did not significantly differ between samples obtained with and without the use of a chase boat (low flow: 50% with and 67% without; high flow: 50% with and 71% without; $T \geq 313$, $P \geq 0.13$ for both). At sampling locations with low flow rates, flathead catfish (particularly juveniles < 300 mm TL) surfaced randomly as far as 30 m upstream or downstream of the sampling vessel, complicating the collection of fish from the chase and electrofishing boats. Morris and Novak (1968) found similar results with the use of low-voltage AC electrofishing, as fish were observed at the surface up to 30 m away from the electrofishing boat. However, flathead catfish typically surfaced in a more predictable pattern at sampling locations where flow rates were greater than 0.30 m/s; at those sites, fish commonly surfaced 10–50 m downstream from the electrofishing boat, suggesting that increased flow rates directed stunned fish downstream of the sampling location, increasing the probability of capture by the chase boat. Although we did not detect significantly greater catch efficiency when a chase boat was used at sampling locations with high flow rates, our analysis was limited to a relatively small sample size ($N < 30$; Table 1). Future studies examining the use of chase boats in lotic systems should attempt to incorporate sampling efforts in high-velocity river reaches to increase our understanding of chase boat efficacy in these areas.

The TL of flathead catfish collected with a chase boat did not significantly differ from that of fish collected without a chase boat ($Z = 0.593$, $P = 0.87$; Figure 2). The mean TL of flathead catfish sampled with and without a chase boat was 341 mm for both (with: range, 87–1,132 mm; without: range, 93–1,070 mm). Cunningham (2004) reported no significant difference in the TL range of flathead catfish collected by pulsed DC electrofishing with and without a chase boat in Oklahoma reservoirs. Although electrofishing techniques have been reported to exhibit size-selective biases when sampling flathead catfish (Vokoun and Rabeni 1999), our results suggest that the proportion of fish collected in each length category with and without a chase boat remains constant.

Although our results may be related to the type of electrofishing unit used, similar behaviors of flathead catfish have been observed with other electrofishing methods. For example, Robinson (1994) found that larger (>375 mm) flathead cat-

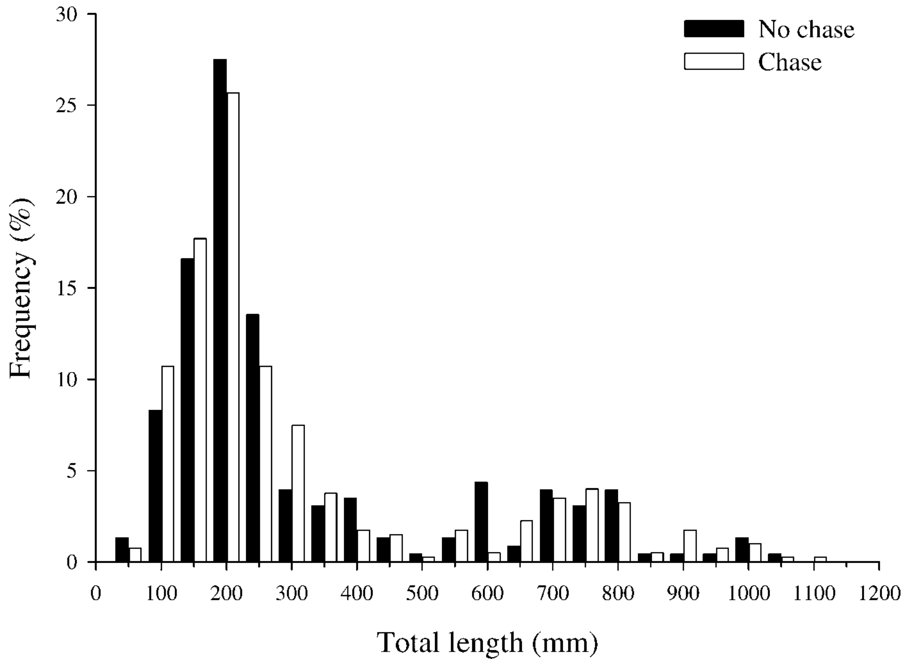

FIGURE 2.—Length frequency distributions of flathead catfish collected by low-voltage AC electrofishing with a chase boat (N = 402) and without a chase boat (No chase; N = 229) in the lower St. Joseph River, Michigan, during 2002 and 2003.

fish sampled with pulsed DC electrofishing from the Missouri River, Missouri, were seldom affected by the electrical field and were rarely captured. Justus (1996) reported that flathead catfish sampled from deepwater (>3.5 m) habitats in Mississippi rivers by use of pulsed DC electrofishing required a greater time to reach the surface and were often observed considerable distances from the electrofishing boat. The similar behavioral responses of flathead catfish to the electric field in our study suggests that regardless of the electrofishing technique employed, the use of a chase boat in riverine environments may increase the electrofishing capture efficiency of flathead catfish. Future studies should also consider the effects of additional environmental variables (e.g., water depth, structural habitat complexity, etc.) to provide further information regarding the utility of chase boats in lotic systems.

The results of our study suggest that the use of a chase boat to enhance electrofishing catch of flathead catfish in lotic systems can increase sampling efficiency but that it does not alter the size distribution of the catch. Chase boats in riverine systems increase collections of flathead catfish that typically surface downstream from the electrofishing boat due to transport of stunned fish in the river current. However, the marginal increase in electrofishing catch efficiency, particularly as environmental conditions (e.g., flow) change among sampling locations for flathead catfish, suggests that chase boats in lotic systems may only be useful if the sampling objective is to maximize fish catch rates when a single electrofishing vessel is available. Our results suggest that if personnel, equipment, and budgetary resources allow, the utilization of two electrofishing vessels sampling independently may result in greater absolute numbers of flathead catfish collected without influencing the size structure of sampled fish. Therefore, we recommend the objectives of sampling efforts be considered when deciding on the use of a chase boat to sample flathead catfish in lotic systems.

Acknowledgments

We would like to thank S. Donabauer, L. Zurita, R. Wyld, A. Gima, and S. Reed for their assistance with field data collections. J. Wesley and J. Dexter, Michigan Department of Natural Resources, Fisheries Division, provided assistance with project development and sampling equipment. Constructive comments on earlier drafts of this manuscript by E. Frimpong, M. Hansen, A. Kennedy, T. Kwak, and three anonymous reviewers improved this manuscript. Funding was provided by the Great Lakes Fishery Trust and Purdue University's Department of Forestry and Natural Resources. The experimental procedures used in this research were approved by the Purdue Animal Care and Use Committee as protocol 01–059. This research was approved for publication as manuscript number 17670 by the Purdue University Agricultural Research Programs.

References

Cunningham, K. K. 1995. Comparison of stationary and mobile electrofishing for sampling flathead catfish. North American Journal of Fisheries Management 15:515–517.

Cunningham, K. K. 2000. Influence of environmental variables on flathead catfish electrofishing catch. Proceedings of the Annual Conference Southeastern Association of Fish and Wildlife Agencies 52(1998):125–135.

Cunningham, K. K. 2004. Efficacy of a chase boat for electrofishing flathead catfish in three Oklahoma reservoirs. North American Journal of Fisheries Management 24:1427–1430.

Daugherty, D. J., and T. M. Sutton. 2005. Seasonal movement patterns, habitat use, and home range of flathead catfish in the lower St. Joseph River, Michigan. North American Journal of Fisheries Management 25:256–269.

Gilliland, E. 1988. Telephone, micro-electronic, and generator-powered electrofishing gear for collecting flathead catfish. Proceedings of the Annual Conference Southeastern Association of Fish and Wildlife Agencies 41(1987):221–229.

Hale, M. M., J. E. Crumpton, and D. J. Renfro. 1987. An inexpensive electrofishing device for collecting catfish. Proceedings of the Annual Conference Southeastern Association of Fish and Wildlife Agencies 38(1984):342–345.

Jackson, D. C. 1999. Flathead catfish: biology, fisheries, and management. Pages 23–35 *in* E. R. Irwin, W. A. Hubert, C. F. Rabeni, H. L. Schramm, Jr., and T. Coon, editors. Catfish 2000: proceedings of the international ictalurid symposium. American Fisheries Society, Symposium 24, Bethesda, Maryland.

Justus, B. 1996. Observations on electrofishing techniques for three catfish species in Mississippi. Proceedings of the Annual Conference Southeastern Association of Fish and Wildlife Agencies 48(1994):524–532.

Morris, L. A., and P. F. Novak. 1968. The telephone generator as an electrofishing tool. Progressive Fish-Culturist 30:110–112.

Robinson, J. W. 1994. Sampling procedures to capture flathead catfish and channel catfish. Missouri Department of Conservation, Fish and Wildlife Research Center, Sport Fish Restoration Project F-1-R-43, Final Report, Columbia.

SPSS. 2001. SPSS base 11.0 applications guide. SPSS, Chicago.

Stauffer, K. W., R. C. Binder, B. C. Chapman, and B. D. Koenen. 1996. Population characteristics and sampling methods of flathead catfish *Pylodictis olivaris* in the Minnesota River. Minnesota Department of Natural Resources, Division of Fish and Wildlife, Section of Fisheries, Study IV, Job 389, St. Paul.

Stauffer, K. W., and B. D. Koenen. 1999. Comparison of methods for sampling flathead catfish in the Minnesota River. Pages 329–339 *in* E. R. Irwin, W. A. Hubert, C. F. Rabeni, H. L. Schramm, Jr., and T. Coon, editors. Catfish 2000: proceedings of the international ictalurid symposium. American Fisheries Society, Symposium 24, Bethesda, Maryland.

Vokoun, J. C., and C. F. Rabeni. 1999. Catfish sampling in rivers and streams: a review of strategies, gears, and methods. Pages 271–286 *in* E. R. Irwin, W. A. Hubert, C. F. Rabeni, H. L. Schramm, Jr., and T. Coon, editors. Catfish 2000: proceedings of the international ictalurid symposium. American Fisheries Society, Symposium 24, Bethesda, Maryland.

Weeks, H., and D. Combs. 1981. Flathead catfish study. Oklahoma Department of Wildlife Conservation, NMFS Project 2–302-R, Final Report, Oklahoma City.